Technical Report

Title: Product wind, water and impact resistance testing of a sample of Aerobrick rainscreen cladding for TI Tiles International Ltd

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TECHNOLOGY CENTRE

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Title: Product wind, water and impact testing of a sample of Aerobrick rainscreen cladding for TI Tiles International

Customer: TI Tiles International Ltd
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UKAS TESTING 0057

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1 INTRODUCTION

This report describes tests carried out at VINCI Technology Centre UK Limited at the request of TI Tiles International Ltd.

The test sample consisted of a sample of Aerobrick rainscreen cladding manufactured by TI Tiles International Ltd.

The tests were carried out in January 2018 and were to determine the wind, water and impact resistance of the test sample. The test methods were in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Wind resistance – serviceability, cyclic & safety.

Watertightness – dynamic pressure.

Impact resistance.

The testing was carried out in accordance with Technology Centre Method Statement C6681/MS rev 0.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for sample(s) tested and the conditions under which the tests were conducted.

The long-term durability of the façade system is not assessed by these test methods.

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- ISO 9001:2008 Quality Management System,
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- BS OHSAS 18001:2007 Occupational Health and Safety Management System.

2 SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Sections 6, 7 and 8.

2.1 SUMMARY OF TEST RESULTS

TABLE 1

Date	Test number	Test description	Result
24 January 2018	1	Wind resistance – serviceability	Pass
24 - 26 January 2018	2	Wind resistance – cyclic	Pass
26 January 2018	3	Wind resistance – safety	Pass
29 January 2018	4	Watertightness - dynamic	Pass
29 January 2018	5	Impact resistance	Pass

2.2 CLASSIFICATION

TABLE 2

Test	Standard	Classification / Declared value	
Wind resistance	CWCT	±2400 pascals – serviceability ±3600 pascals – safety	
Watertightness - dynamic	CWCT	600 pascals	
Soft body impact resistance	CWCT TN76	120 Nm serviceability – Class 1 500 Nm safety – Negligible risk	
Hard body impact resistance	CWCT TN76	<u>Mortar joints</u> 3 Nm serviceability Class 1 3 Nm safety Negligible risk 6 Nm serviceability Class 1 10 Nm serviceability Class 1 (insulated) Class 2 (cavity) 10 Nm safety Negligible risk	<u>Open joints</u> 3 Nm serviceability Class 1 3 Nm safety Negligible risk 6 Nm serviceability Class 3 10 Nm serviceability Class 4 10 Nm safety Low risk

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

The sample was as shown in the photo below and the drawings included as an appendix to this report.

The following sample description was supplied by T.I.Tiles International.

T.I.Tiles International Ltd Aerobrik mechanical brick slip system.

The following is a product and fixing description of the mechanically fixed Aerobrik brick slip cladding system; a two component system comprising of a Veco Galvalume plate available in flat or cassette format to receive and support clinker brick slips.

The test rig in the attached images comprises two backing walls, a composite panel in this instance Eurobond Rainspan and a proprietary vertical sub-frame assembly. Resulting in two through wall scenarios, a façade and a rainscreen.

The rig by VINCI Technology Centre comprised a constructed backing wall of vertical studs at 600mm c/c c/w a 20mm thick marine plywood front fixing face finish to this we fixed 4no 3m by 1.2m composite cladding panels in a landscape orientation for one half of our test; these were fixed at both ends and one midpoint at 300mm c/c vertically and stacked upon one another to create a 3m by 4.8m flat support wall.

The flat support tray 2.363m by 505mm (standard size) was fixed directly to the front skin only, of the composite cladding panel by "bulb tite" flush rivets. These we installed at 300mm c/c horizontally by 250mm c/c vertically; as can be seen in the attached images. The flat tray comprises punched out hook anchorage points and point load locking tabs strategically located above to engage on the shoulder of the clinker brick slip ensuring a precise and snug fit when installed correctly.

This represents a façade only as there is no vertical free airflow zone; whilst on the second half we created a rainscreen by installing a proprietary vertical sub-frame assembly with T-rails fixed at 600mm c/c and helping hand brackets at 750mm c/c through the marine plywood back into the vertical mainframe studs at 600mm c/c. To this vertical sub-frame, we fixed the cassette format of the Veco Galvalume support plate, this cassette tray measured 2.475m by 517mm and has a continuous 18mmx15mm standoff running around all four edges.

When fixing back to the vertical sub-frame at spans of 600mm c/c we included a supplementary horizontal top-hat profile 15mm deep to for variable to excessive wind loads; the fixing centers for this cassette was 600mm c/c by 250mm c/c with "bulb tite" flush rivets.

Slips can be installed in any orientation both landscape or portrait and all trays cut to size.

One half of each fixing formats was pointed to test as sealed and unsealed both obtaining results confirming the systems strength and robustness qualities.

PHOTO 6845

TEST SAMPLE

PHOTO 6429

SAMPLE DURING BUILD

PHOTO 6794

TEST SAMPLE DURING BUILD

3.2 CONTROLLED DISMANTLING

During the dismantling of the sample no discrepancies from the drawings were found.

PHOTO 7225

TEST SAMPLE DURING DISMANTLE

PHOTO 7226

TEST SAMPLE DURING DISMANTLE

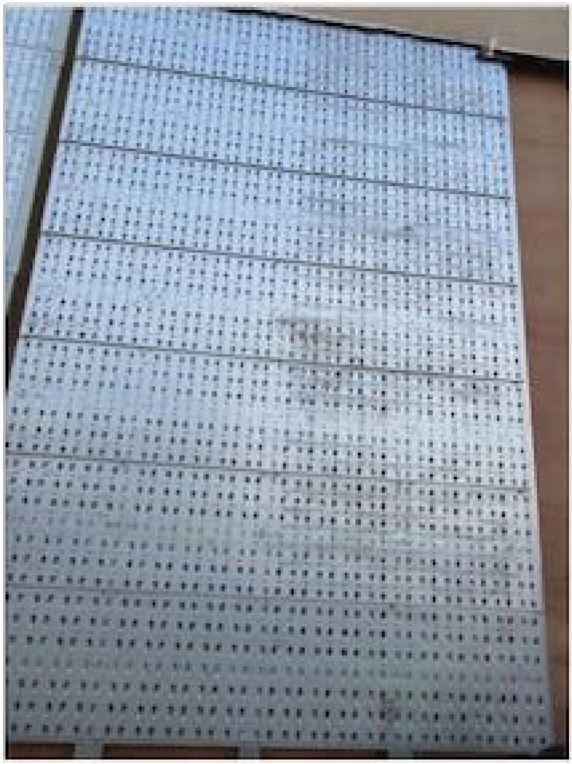


PHOTO 7227

TEST SAMPLE DURING DISMANTLE

PHOTO 7227

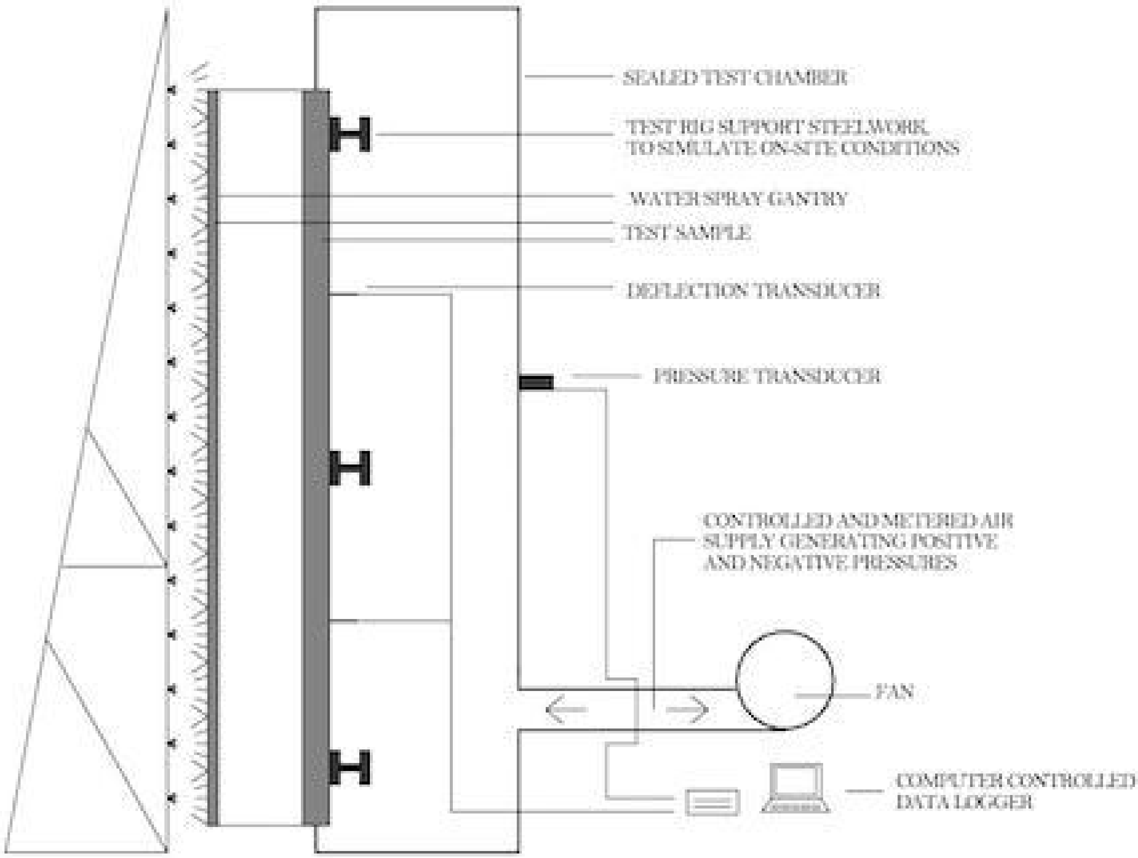
TEST SAMPLE DURING DISMANTLE

4 TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of TI Tiles International installed the sample on the test rig. See Figure 1.

FIGURE 1

TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

5 TEST SEQUENCE

The test sequence was as follows:

(1) Wind resistance – serviceability

(2) Wind resistance – cyclic

(3) Wind resistance – safety

(4) Watertightness - dynamic

(5) Impact resistance

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6 WIND RESISTANCE TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Deflection

Displacement transducers were used to measure the deflection of principle framing members to an accuracy of 0.1 mm. The gauges were set normal to the sample framework at mid-span and as near to the supports of the members as possible and installed in such a way that the measurements were not influenced by the application of pressure or other loading to the sample. The gauges were located at the positions shown in Figure 2.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE

Note: *The open joints between the bricks were sealed for the wind resistance tests only.*

6.3.1 Wind Resistance – serviceability

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 2400 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of -2400 pascals.

6.3.2 Wind Resistance – safety

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 3600 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of –3600 pascals.

6.3.3 Wind Resistance – cyclic

The test sample was subjected to pressure pulses as shown in Table 1. The sequence was repeated five times followed by a single application of the design wind pressure (±2400 pascals). Each pressure cycle took approximately twelve seconds.

TABLE 3

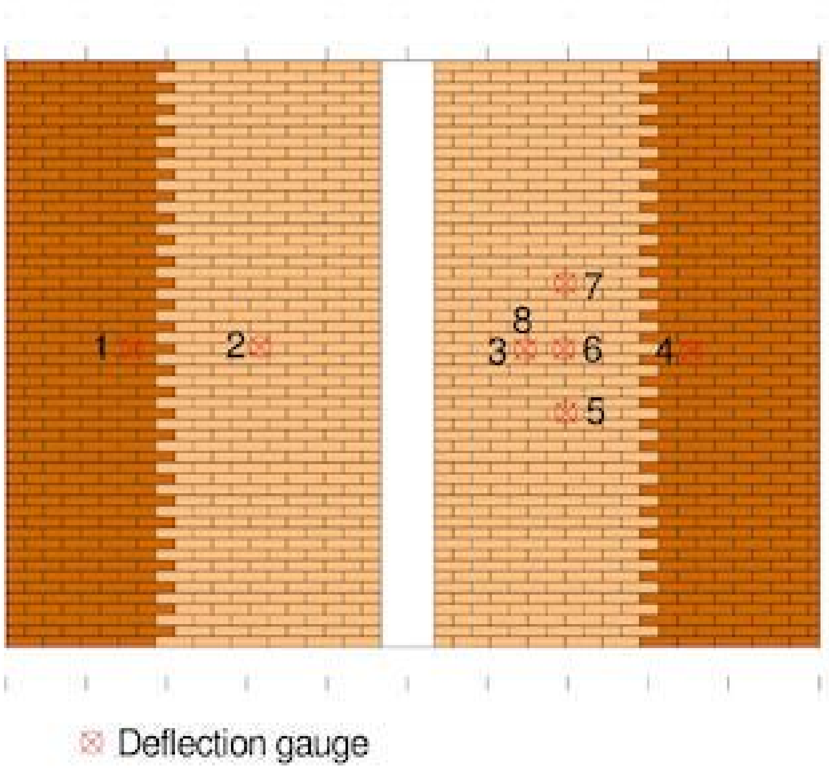
Load as fraction of design wind pressure	Number of cycles	Applied load
90%	1	±2160 Pa
40%	960	±960 Pa
60%	60	±1440 Pa
50%	240	±1200 Pa
80%	5	±1920 Pa
70%	14	±1680 Pa

Any damage or functional defects were recorded.

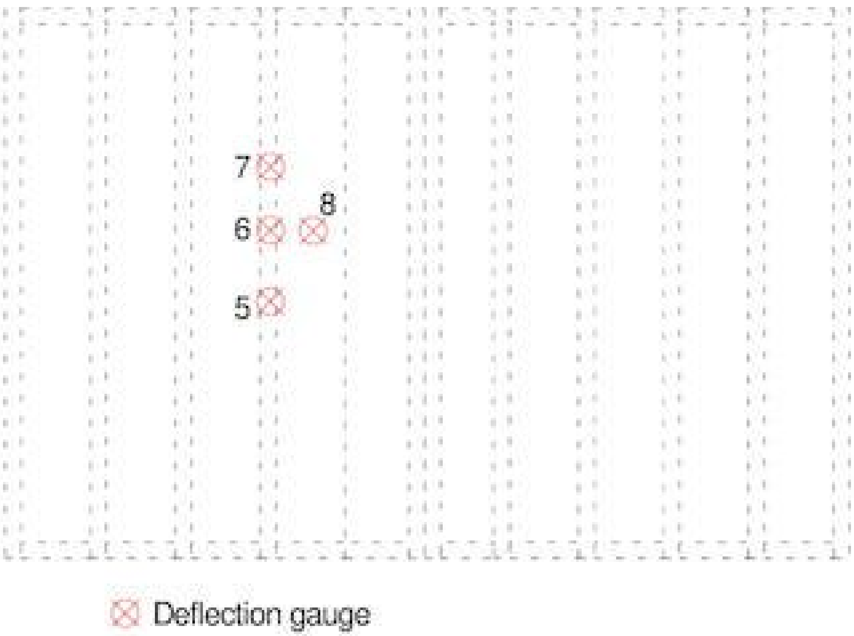
FIGURE 2

DEFLECTION GAUGE LOCATIONS

External View



Internal View



6.4 PASS/FAIL CRITERIA

6.4.1 Calculation of permissible deflection

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
6	Support rail	800	L/200 = 4.0	1 mm

6.5 RESULTS

Test 1 (serviceability) Date: 24 January 2018

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 4 and 5.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
6	Support rail	2413 -2403	0.1 -0.5	-0.2 0.1

No damage to the test sample was observed.

Ambient temperature = 13°C
Chamber temperature = 14°C

Test 2 (cyclic) Date: 24 - 26 January 2018

No damage to the sample was observed during the cyclic wind loading test.

Ambient temperature = 4 - 13°C
Chamber temperature = 5 - 14°C

Test 3 (safety) Date: 26 January 2018

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 6.

No damage to the sample was observed.

Ambient temperature = 6°C
Chamber temperature = 6°C

TABLE 4

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	605	1209	1799	2413	Residual
1	0.6	1.3	1.9	2.5	0.1
2	0.8	1.6	2.5	3.3	0.2
3	0.7	1.5	2.5	3.4	0.2
4	0.7	1.4	2.2	3.0	0.2
5	0.0	0.1	0.2	0.2	0.1
6	0.1	0.1	0.2	0.3	0.0
7	0.0	0.0	0.0	0.1	0.1
8	-0.1	-0.3	-0.5	-0.6	0.0
6 *	0.1	0.1	0.1	0.1	-0.2

*adjusted for movement at the supports

TABLE 5

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-595	-1213	-1802	-2403	Residual
1	-0.8	-1.7	-2.9	-4.2	-0.3
2	-1.0	-2.2	-3.7	-5.5	-0.3
3	-0.9	-2.0	-3.4	-5.0	-0.6
4	-0.8	-1.8	-3.2	-4.5	-0.8
5	-0.1	-0.4	-1.1	-1.7	-0.4
6	-0.2	-0.7	-1.4	-2.1	-0.5
7	-0.1	-0.4	-1.0	-1.6	-0.4
8	-0.0	-0.2	-0.6	-1.1	-0.3
6 *	-0.1	-0.2	-0.3	-0.5	0.1

*adjusted for movement at the supports

TABLE 6

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)			
	3633	Residual	-3604	Residual
1	3.8	0.2	-6.9	-0.7
2	4.4	0.3	-8.5	-0.7
3	5.1	0.4	-7.7	-0.9
4	5.0	0.6	-7.0	-1.0
5	0.3	0.2	-2.5	-0.8
6	0.8	0.4	-3.2	-0.8
7	0.5	0.5	-2.7	-0.8
8	-1.1	0.1	-1.9	-0.7
6 *	0.4	0.0	-0.6	0.0

*adjusted for movement at the supports

7 WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

7.1.2 Water Flow

An in-line water flow meter was used to measure water supplied to the spray gantry to within 5%.

7.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air and water temperatures to within 1°C.

7.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

7.2 FAN

A wind generator was mounted adjacent to the external face of the sample and used to create positive pressure differentials during dynamic testing. The wind generator comprised a piston type aero-engine fitted with 4 m diameter contra-rotating propellers.

7.3 WATER SPRAY

The water spray system comprised nozzles spaced on a uniform grid not more than 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full-cone pattern with a spray angle between 90° and 120°. The spray system delivered water uniformly against the exterior surface of the sample.

7.4 PROCEDURE

Water was sprayed onto the sample using the method described above at a flow rate of at least 3.4 litres/m^2/minute.

The aero-engine was used to subject the sample to wind of sufficient velocity to produce average deflections in the principle framing members equal to those produced by a static pressure differential of 600 pascals. These conditions were maintained for 15 minutes. Throughout the test the inside of the sample was examined for water penetration.

7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the sample throughout testing. At the completion of the test there shall be no standing water in locations intended to remain dry.

PHOTO 6901

DYNAMIC WIND GENERATOR

7.6 RESULTS

Test 4 Date: 29 January 2018

No water leakage was observed through the bricks with the mortar joints.

No water leakage was observed through the open jointed bricks with the insulated panels.

Water leakage observed through the open jointed bricks was mainly confined to the support panels and drained out at the base of the cavity during and after testing.

Chamber temperature= 6°C
Ambient temperature = 6°C
Water temperature = 9°C